

Note on a Range Extension and Observations of Spawning in *Tegula*, a Gastropod

BY

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THE NORTHERNMOST RECORD for *Tegula brunnea* heretofore has been from Mendocino County, California. However, I collected *T. brunnea* from Cape Arago, Oregon, Lat. 43° 18' 10" N, Long. 124° 20' W, in the summers of 1960, 1963 and 1964. It seems to be a regular inhabitant of the outer intertidal zone there. In 1960, it was collected at Middle Cove of Cape Arago and in the two later years at North Cove, which is 2° 52' further north than the former California record; here it is usually associated with *T. pulligo* in the *Macrocystis* area. KEEN & DOTY (1942) record only two species from this area; they are *T. funebris* and *T. pulligo*. The known range for *T. brunnea* is now from Coos Bay, Oregon south to Santa Barbara, California.

The characteristics of *Tegula brunnea* in Oregon are: shell with umbilicus closed; shell either gray above with orange or red-brown body whorl or totally orange or red-brown; no teeth on columella evident; foot black with a prominent orange or red-brown border, mantle lobes near head (collar) black but with yellow borders. Epipodia wholly black. According to Dr. Rudolf Stohler (*in litt.*, 1964), these northern forms appear larger than similar Californian material.

Body coloration coupled with shell characteristics seems to afford a good guide for separating the Oregon species of *Tegula*. A short key to the known Oregon species is offered below.

Key to the Oregon Species of *Tegula*

1. Umbilicus covered by a callus, closed; epipodia of uniform color throughout 2
- Umbilicus open; epipodia lighter near base
..... *Tegula pulligo* (GMELIN, 1784)
2. Shell color purplish or black; tooth evident on columella *Tegula funebris* (A. ADAMS, 1855)
- Shell greyish above, with red-brown to orange body whorl or entirely brown; no teeth on columella evident *Tegula brunnea* (PHILIPPI, 1848)

Tegula funebris differs from *T. pulligo* in that the tentacles, head, upper portion of the foot and the epipodia as well as the collar or mantle lobes are wholly black. In *T. pulligo* the head is black dorsally, epipodia light colored

at bases; antennae black, foot black with lavender-purple blotched or wine-colored to red-brown border; mantle lobes (collar) above head pinkish with yellow borders. Additionally, the shell color of *T. pulligo* is gray on top or with light colored blotches apically; body whorl with thin yellow or red-orange bands; sometimes entire shell magenta in color.

On August 8, 1964, several specimens each of both *Tegula brunnea* and *T. pulligo* were collected in the outer *Macrocystis* area of North Cove, Cape Arago, Oregon. They were placed in aquaria with running sea water at the Oregon Institute of Marine Biology, Charleston, Oregon; the water temperature was maintained at 15° to 16° C. The next night, alerted by the cloudiness of the water in the tank, I noted that one of the *T. brunnea* was discharging puffs of white sperm. Further observation revealed that female *T. brunnea* were laying eggs, bright grass-green in color. These eggs seemed to cover the body whorl in a single sheet as the snail held on to the side of the aquarium. After a time these eggs dropped off and fell to the bottom of the tank, which by this time was covered by large masses of the green eggs. At no time did the males appear to be attracted to the females, but they remained at a distance of from five to six inches. However, the possibility remains that one may stimulate spawning in the other. No egg capsules were built, the gametes being shed directly into the immediate environment.

Gametes were removed separately and fertilization was attempted. Upon fertilization most of the eggs appeared to have a fertilization membrane and several turned light green (moss-green) in color. Most of the zygotes attained the two-cell stage after about 50 minutes. Development continued until the 16-cell stage and then stopped. No later stages were found.

In speaking of *Tegula funebris*, Dr. Peter Frank (*in litt.*, 1964), says that on August 13, 1964, three females of this species were observed with eggs within the shell when they retracted the foot upon being picked up. Many eggs were noted in the immediate vicinity. One of the snails was collected and its eggs were watched, in the

laboratory at Charleston; most did not cleave, only a few developed to the 4-cell stage or to subsequent stages. The three snails in question were found during low tide at about the plus 3.5 foot level.

These two observations, both made in August, appear to be the only recorded cases of spawning noted in these common snails.

LITERATURE CITED

KEEN, A. MYRA & CHARLOTTE L. DOTY

1942. An annotated check list of the gastropods of Cape Arago, Oregon. Oregon State Monogr. 3. Corvallis, Oregon.

Three Dimensional Reconstructions of the Nests of *Helix aspersa*

(Mollusca : Gastropoda : Pulmonata)

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(Plate 30)

THE GROSS ASPECTS of the reproductive process in *Helix aspersa* have been reported at some length. The courtship process was described in detail by TRYON (1882), while other reports have dealt with the copulatory act, oviposition, hatching, and movement out of the nest (BASINGER, 1931; INGRAM, 1946 and 1947; HERZBERG & HERZBERG, 1962). In addition to the above factors which contribute to the total picture of reproductive behavior in this animal there must be added nest building, also a reproductive trait. A search of the literature failed to reveal any description of the actual three-dimensional structure of the nest in the ground in which this animal deposits its eggs. This experiment was designed to determine the nest structure of *Helix aspersa*.

MATERIALS AND METHODS

Twenty pairs of snails were placed separately in quart glass jars with aluminum screening covers. To permit clear observation of oviposition the bottom of each jar

had moist soil about 5 cm in depth. It had earlier been determined that this amount of soil permitted observation of oviposition (HERZBERG & HERZBERG, 1962).

The animals were observed several times daily through the sides or bottom of the jars until they were found actually depositing eggs. When such animals were found they were disturbed by tapping with a pencil on their shells, followed by a slow lifting of the shell away from the soil. As the animal ceased oviposition and withdrew its body from the soil and toward the shell, it was further lifted out of the nest until the body was entirely freed. When conducted with much care, this procedure permitted removal of the animal without any visible distortion of the nest, thus leaving the nest cavity open with eggs visible at its bottom. Into the nest opening a loose mixture of plaster of Paris was poured, and gently vibrated into the nest opening until it overflowed the top, and then left to dry. After drying, the hard plaster mass was withdrawn from the soil and the particles of soil

Explanation of Plate 30

Figures 1 a, b, c: Three views of the plaster of Paris models of the blunt thumb-shaped nest of *Helix aspersa*.

Figures 2 a, b, c: Three views of the plaster of Paris models of the nest of *Helix aspersa* showing the long neck and the rounded bottom.